In the United States Patent and Trademark Office

Appn. Number: _____

Appn. Filed: _____

Applicant(s): Tiwald

Appn. Title: Method for Evaluating Complex Refractive Indicies Utilizing IR #4
1324 Range Ellipsometry

Examiner/GAU: _____

Mailed: With Application

At: _____

Information Disclosure Statement

Commissioner of Patents and Trademarks
Washington, District of Columbia 20231

Sir:

Attached is a completed Form PTO-1449 and copies of the pertinent parts of the references cited thereon.

Following are comments on these references pursuant to Rule 98:

INFORMATION DISCLOSURE

PATENTS

Patent, to Dill, No. 4,053,232 describes a Rotating-Compensator Ellipsometer System, which operates utilizes monochromatic light.

Patent Nos. 5,596,406 to Rosencwaig et al. describes a material system investigating system.

Patent No. 4,668,086, to Redner, describes a material system investigating system.

Patent to Woollam et al, No. 5,373,359 as it describes a Rotating Analyzer Ellipsometer System which utilizes white light.

Patents continued from the 359 Woollam et al. Patent are Nos:

5,504,582 to Johs et al. and
5,521,706 to Green et al.

Said 582 Johs et al. and 706 Green et al. Patents describe use of polychromatic light in a Rotating Analyzer Ellipsometer System.

Patent to Bernoux et al., No. 5,329,357 is identified as it describes the use of optical fibers as input and output means in an ellipsometer system.

Patent to Chen et al., No. 5,581,350 is identified as it describes the application of regression in calibration of ellipsometer systems.

Patent to Herzinger, No. 5,835,222, is identified, and incorporated hereinto by reference, as it describes an ellipsometric based method for identifying the orientation of an optical axis in a material system with respect to an alignment surface thereof.

Patent, No. 5,757,494 to Green et al., is identified as it describes a method for enabling investigation of a material system with ellipsometer systems, even in ellipsometric PSI and/or DELTA regions wherein said ellipsometer system is, without the invention, "blind", (eg. DELTA of (0.0) or (180) degrees) in Rotating Polarizer and Rotating Analyzer Ellipsometer Systems, and/or (PSI or (45) degrees in Modulation Element Ellipsometer Systems).

Patent to Johs et al., No. 5,872,630, is also disclosed as it describes rotating compensator ellipsometer system and a method of evaluating material system characteristics, involving application of mathematical regression onto data acquired by application of electromagnetic beams thereto in the context of a Rotating Compensator Ellipsometer System.

Patents Nos.

5,666,201, and
5,805,285,

to Johs et al describe, respectively, a spectroscopic ellipsometer and a spectroscopic spectrophotometer system, wherein a spectroscopic beam of electromagnetic radiation is caused to interact with a dispersive optics to the end that multiple orders of wavelengths are produced and detected.

Patent to Herzinger et al. No. 5,796,983 is identified as it describes the Kramers-Kroenig relationship as it applies to novel Dielectric Function Parametric model oscillator structures.

SCIENTIFIC ARTICLES

Scientific articles which are of direct interest, and which are included herewithin by reference are:

"Optical Characterization Of Anisotropic Plastics", Hilfiker, Herzinger, Bungay, Woollam & Elman, Optical Interference Coatings, Op. Soc. Am, Tech. Dig. Series, Vol. 9, ((1998).

"Characterization of Bi-Axially-Stretched Plastic Films By

Generalized Ellipsometry", Elman, Greener, Herzinger & Johs, Thin Solid Films, 313-314 (1998).

"Phase And Microstructure Investigations Of Boron Nitride Thin Films By Spectroscopic Ellipsometry In The Visible And Infrared Spectral Range", Franke, Schubert, Neumann, Tiwald, Thompson, Woollam, Hahn & Richter, J. Appl. Phys. 82(6), (Sept. 1997).

"Determination Of Optical Anisotropy In Calcite From Ultraviolet To Mid-Infrared By Generalized Ellipsometry", Thompson, DeVries, Tiwald, & Woollam, Thin Solid Films, 313-314 (1998).

An article by Johs, titled "Regression Calibration Method For Rotating Element Ellipsometers", which appeared in Thin Film Solids, Vol. 234 in 1993 is also identified as it predates the Chen et al. 350 Patent and describes an essentially similar approach to ellipsometer calibration.

An article by Jellison Jr. titled "Data Analysis for Spectroscopic Ellipsometry", Thin Film Solids, 234, (1993) is identified as it describes a method for determining the accuracy with which certain data points can be measured, which information allows adding a weighting factor to a curve fitting regression procedure as applied to a multiplicity of data points, said weighting factor serving to emphasize the effect of more accurate and precise data.

An Article by Collins titled "Automated Rotating Element Ellipsometers: Calibration, Operation, and Real-time Applications, Rev. Sci. Instrum. (61(8), August 1990 is identified as it provides insight into rotating element ellipsometers.

A book by Azzam and Bashara titled "Ellipsometry and Polarized light" North-Holland, 1977 is disclosed and incorporated herein by reference for general theory, (not included).

An article by Kleim et al. titled "Systematic Errors in Rotating-Compensator Ellipsometry" published in J. Opt. Soc. Am./Vol. 11, No. 9, Sept 1994 is identified as it describes calibration of rotating compensator ellipsometers.

Also disclosed are articles by Schubert et al. which describe "Generalized Ellipsometry":

1. "Extension Of Rotating-Analyzer Ellipsometry To Generalized Ellipsometry: Determination Of The Dielectric Function Tensor From Uniaxial TiO2", J. Opt. Soc. Am. A. 13, (1996). This article describes methodology for evaluating all components of a Mueller Matrix dielectric function, but does not describe first diagonalizing said Mueller Matrix and evaluating components of only the three resulting complex dielectric functions or refractive indicies.

2. "Polarization Dependent Parameters Of Arbitrary Anisotropic Homogeneous Epitaxial Systems", Phys. Rev. B 53, (1996).

3. "Generalized Transmission Ellipsometry For Twisted Biaxial Dielectric Media: Application To Chiral Liquid Crystals", J. Opt. Soc. Am. A/Vol. 13, No. 9 (1996).

The Schubert et al. articles, it is noted, describe ellipsometer systems which have rotatable material system supporting stages, and primarily focus on investigation of material systems, utilizing said ellipsometer systems, which, (in general terms), material systems have isotropic "in-plane" refractive indices, (ie. where $n_x = n_y$).

Further identified for authority regarding mathematical regression is a book titled Numerical Recipes in "C", 1988, Cambridge University Press, (not included).

SINCERELY,

JAMES D. WELCH
REG NO. 31,216

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"Optical Characterization Of Anisotropic Plastics", Hilfiker, Herzinger, Bungay, Woollam & Elman, Optical Interference Coatings, Op. Soc. Am, Tech. Dig. Series, Vol. 9, ((1998).

"Characterization of Bi-Axially-Stretched Plastic Films By Generalized Ellipsometry", Elman, Greener, Herzinger & Johs, Thin Solid Films, 313-314 (1998).

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2. "Polarization Dependent Parameters Of Arbitrary Anisotropic Homogeneous Epitaxial Systems", Phys. Rev. B 53, (1996).

3. "Generalized Transmission Ellipsometry For Twisted Biaxial Dielectric Media: Application To Chiral Liquid Crystals", J. Opt. Soc. Am. A/Vol. 13, No. 9 (1996).

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ATTY. DOCKET NO.	SERIAL NO.
APPLICANT Tiwald	
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LIST OF PRIOR ART CITED BY APPLICANT

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U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
	AA	5796983	8/1998	Herzinger	395	500	
	AB	4053232	10/1991	Dill et al	356	118	
	AC	5596406	1/1997	Rosencwaig et al.	356	327	
	AD	4668086	5/1987	Redner	356	367	
	AE	5373359	12/1994	Woollam et al	356	328	
	AF	5550458	4/1996	Jahr et al.	356	369	
	AG	5521706	5/1996	Green et al.	356	369	
	AH	5329352	7/1994	Bernoux et al.	356	369	
	AI	5581350	12/1996	Chen et al	356	369	
	AJ	5835222	11/1998	Herzinger	356	369	
	AK	5757494	5/1998	Green et al.	356	369	

FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO
	AL							
	AM							

OTHER PRIOR ART (Including Author, Title, Date, Pertinent Pages, Etc.)

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U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
	AA	5872630	2/1999	Johs et al.	356	369	
	AB	5666201	9/1997	Johs et al.	356	369	
	AC	5805285	9/1998	Johs et al.	356	369	
	AD	5796483	8/1998	Herzinger et al.	395	500	
	AE						
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	AJ						
	AK						

FOREIGN PATENT DOCUMENTS

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